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ORIGINAL

FLOOD INSURANCE STUDY

COMPLETED
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BOROUGH OF STANHOPE, NEW JERSEY
SUSSEX COUNTY

MAY 17, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 340456

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
BOROUGH OF STANHOPE, NEW JERSEY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Stanhope, Sussex County, New Jersey, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Stanhope to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the New Jersey Department of Environmental Protection for the Federal Emergency Management Agency, under Contract No. H-3959. This work was completed in August 1980. The hydrologic and hydraulic analyses for this study were conducted by Anderson-Nichols and Co., under subcontract to the New Jersey Department of Environmental Protection.

1.3 Coordination

Streams requiring detailed study were identified at an initial Consultation and Coordination Officer's (CCO) meeting in September 1976. This meeting was attended by representatives of the New Jersey Department of Environmental Protection (NJDEP - the study contractor), the FEMA and the Borough of Stanhope. Results of the hydrologic analyses were coordinated with the U. S. Geological Survey (USGS) and the U. S. Army Corps of Engineers (COE).

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On December 21, 1981, the results of this study were reviewed at the final CCO meeting attended by representatives of the study contractor, FEMA and community officials.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Stanhope, Sussex County, New Jersey. The area of study is shown on the Vicinity Map (Figure 1).

The Musconetcong River was studied by detailed methods for its entire length within the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through August 1985.

2.2 Community Description

The Borough of Stanhope is a residential community of approximately 1.7 square miles. It is located in southern Sussex County, about 50 miles north of Trenton, New Jersey, 40 miles west of New York City and 70 miles northeast of Philadelphia, Pennsylvania. Stanhope is bordered by the Township of Hopatcong on the northeast, the Townships of Roxbury and Mt. Olive and the Borough of Netcong on the south and by the Township Byram on the northwest and east.

The 1970 population of Stanhope was 3,040, an increase of 68 percent over the previous 10 year period (Reference 1). The population density in the borough is 1,788 people per square mile.

Sussex County was settled in the early 1700's as an agricultural area. During the 1800's, some industries developed, including the production of zinc ore and limestone products. The production of silk goods was also an important industry (Reference 2). The Borough of Stanhope was incorporated in March 1904 and developed mainly as a residential community.

The principal waterway in Stanhope is the Musconetcong River, with a drainage area of 158 square miles. Originating in Lake Hopatcong, the Musconetcong loops to the northwest after flowing through Lake Musconetcong and then flows southwest, forming the border of Warren County, until reaching the Delaware River in Riegelsville, New Jersey.

The central region of the Delaware River basin includes four geological provinces. The Musconetcong and its tributaries are within the Reading Prong of the New England Upland subprovince, which is called the

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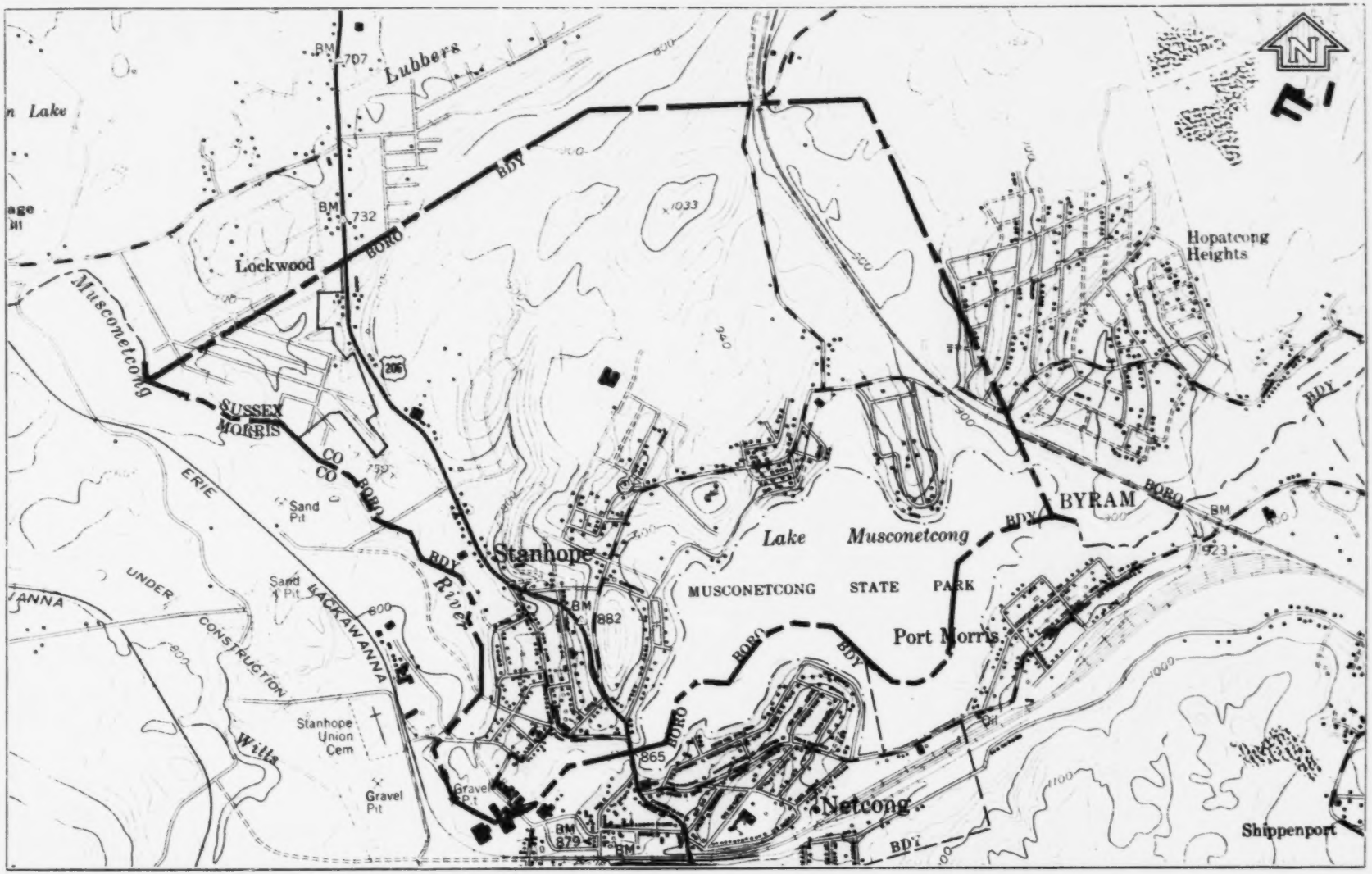

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

3

VICINITY MAP

Highlands in New Jersey. The topographic relief of this area is moderate and characterized by approximately parallel, irregular ridges and intervening valleys trending northeast. The ridges, which rise about 500-1,000 feet above the valleys, are composed of gneiss and related hard crystalline rocks. The valleys are underlain by weaker rocks, principally carbonate rocks and shale. Most of the New England province has been glaciated. In the northeastern part, the ridges are blanketed by extensive deposits of glacial till while the valleys contain thicker deposits, largely outwash, which completely mask the bedrock in most places.

The climate of this region is mostly continental due to the predominance of winds from the interior. Winter climate is controlled by polar continental air masses, and the summer climate is controlled by tropical air masses moving up over the United States from the Gulf of Mexico. Average seasonal temperatures range from 31.5 degrees Fahrenheit (°F) in January to 77.5 °F in July, with extremes of -16 and 106°F. The average annual precipitation is 45.2 inches.

2.3 Principal Flood Problems

The history of flooding in Stanhope indicates that flooding of varied origin may be experienced in any season of the year since New Jersey lies within the major storm tracks of North America. Flooding during winter months is less frequent, but spring flooding compounded by ice and snow melt has occured. The more extensive floods generally occur in late summer or early fall and are usually associated with tropical disturbances moving north along the Atlantic coast.

The recorded history of flooding in the Musconetcong River basin near the outlet to Lake Hopatcong began in 1929. Since then, several major floods have occurred and minor floods have been a common occurrence. Based on peak stages and discharges of USGS gaging station No. 01455500 near the outlet to Lake Hopatcong the dates of eleven major flooding events are as follows: July 11, 1931, March 19, 1936, October 20, 1936, July 24, 1938, August 20, 1955, October 3, 1955, August 5, 1969, September 24, 1970, June 24, 1972, February 14, 1975 and January 25, 1979 (Reference 3). The storm of January 25, 1979 had a discharge of 2,200 cubic feet per second (cfs) and a recurrence interval of 90 years at the Hackettstown, New Jersey gage. On August 27-28, 1971, New Jersey was hit by Hurricane Doria rendering the state a natural disaster area. An extensive high water mark survey was conducted jointly by the State of New Jersey and the USGS following Doria; these data are on file with the NJDEP Division of Water Resources.

2.4 Flood Protection Measures

There are no existing flood control or flood protection structures in Stanhope. However, flood plain regulations were adopted on May 31, 1979.

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In an effort to minimize damages, the Division of Water Resources of the NJDEP has adopted rules, regulations and minimum standards concerning development and use of land within the floodway. Land use regulations adopted from the code of Federal Regulations, sound flood plain zoning and the possible acquisition of land for open-space application are other non-structural measures of mitigating future flood damage (Reference 4).

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail affecting the community.

The discharges along the Musconetcong River from its mouth at the junction with the Delaware River upstream to Lake Musconetcong, a distance of 41.5 miles, have been determined by the Flood Plain Management Section of the Bureau of Flood Plain Management, Division of Water Resources, NJDEP, using a log-Pearson Type III distribution for gages at Bloomsbury and Hackettstown, New Jersey, and at the outlet to Lake Hopatcong.

A summary of drainage area-peak discharge relationships for the stream studied in detail is shown in Table 1, "Summary of Discharges".

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TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MUSCONETCONG RIVER					
At downstream corporate limits	32.3	638	1,000	1,181	1,679
Upstream of Wills Brook in the Township of Mt. Olive	28.2	564	881	1,040	1,474

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding source studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along this flooding source.

Cross sections for the backwater analyses of the Musconetcong River were obtained from aerial photographs flown in December 1977 (Reference 5). The below water sections were obtained from the COE and the State of New Jersey Works Project Administration (WPA) (References 6 and 7). All bridges, dams and culverts were field checked to obtain elevation data and structural geometry.

In undeveloped stream segments, or long segments between structures, cross sections were located at regular intervals and at changes in valley configuration. Cross sections were taken at close intervals up and downstream of structures and used in conjunction with the significant hydraulic features of the structures to determine their ability to pass flood flows.

Channel roughness factors (Manning's "n") used in the hydraulic computations, were chosen by engineering judgement and based on field observations. Roughness values for the main channel of the Musconetcong River ranged from 0.015 to 0.050, with flood plain values ranging from 0.050 to 0.075 for all floods. The acceptability of all assumed hydraulic factors, cross sections and hydraulic structure data was checked by computations that duplicated historic flood water profiles.

Water surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step backwater computer program (Reference 8). Starting water surface elevations for the Musconetcong River were obtained from the Flood Insurance Study for the Township of Byram (Reference 9).

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Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

At some locations along the studied stream, hydraulic conditions may create a situation of supercritical flow. Because of the inherent instability of such a condition, an assumption of critical depth has been adopted for the backwater analyses of this study.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps compiled from aerial photographs at a scale of 1:2,400 with a contour interval of 5 feet (Reference 10). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

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4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. However, the State of New Jersey has established criteria limiting the increase in flood heights to 0.2 foot. Thus, a floodway having no more than a 0.2-foot surcharge has been delineated for this study. The floodway in this report is presented to local agencies as a minimum standard that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway widths for the Musconetcong River extend beyond the corporate limits.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 0.2 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Musconetcong River								
A	0	120/15	161	5.6	710.9	710.9	710.9	0.0
B	965	90/5	157	5.7	726.4	726.4	726.4	0.0
C	1,530	128/100	174	5.2	736.5	736.5	736.5	0.0
D	2,310	237/10	242	3.7	750.9	750.9	751.0	0.1
E	4,105	146/30	197	4.6	780.1	780.1	780.1	0.0
F	4,790	83/70	320	2.8	782.1	782.1	782.3	0.2
G	5,210	131/116	268	3.4	786.5	786.5	786.5	0.0
H	5,666	30/10	145	6.2	791.6	791.6	791.6	0.0
I	6,210	29/15	90	10.0	796.3	796.3	796.3	0.0
J	6,980	33/10	132	6.8	814.4	814.4	814.4	0.0
K	7,190	23/14	91	9.9	816.0	816.0	816.1	0.1
L	7,485	27/10	94	9.6	818.5	818.5	818.5	0.0
M	7,810	20/5	115	7.8	835.6	835.6	835.6	0.0
N	7,940	110/55	835	1.1	837.3	837.3	837.4	0.1
O	9,050	26/10	90	10.1	838.4	838.4	838.4	0.0
P	9,520	320/40	2,545	0.4	861.7	861.7	861.7	0.0
Q	17,682	815/400	2,827	0.3	861.7	861.7	861.7	0.0

[1]Feet above corporate limits
[2]Width/width within corporate limits

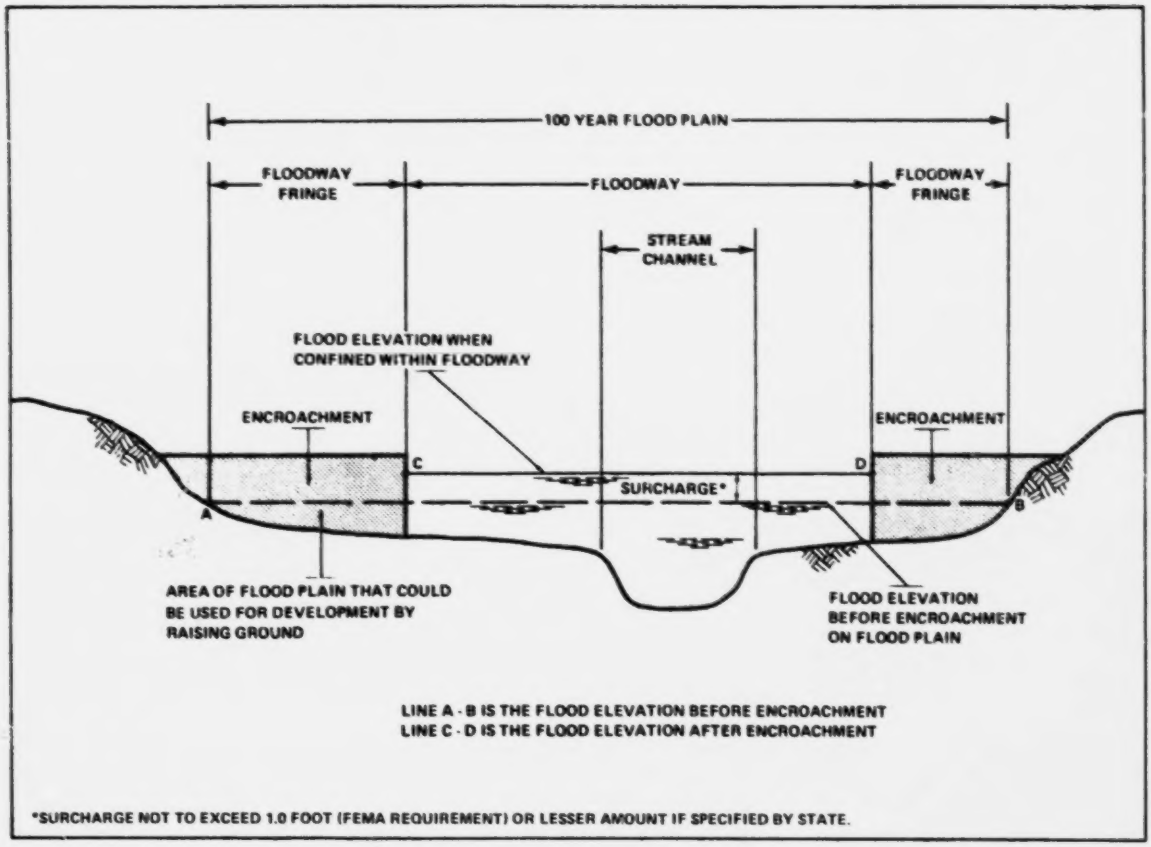
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

FLOODWAY DATA

9 MUSCONETCONG RIVER


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

Factors (FHFs), and flood insurance zone designations for the flooding source affecting the Borough of Stanhope.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding source of the Borough of Stanhope are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Musconetcong River Reach 1	01	-0.8	-0.3	+0.6	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

FLOOD INSURANCE ZONE DATA

// MUSCONETCONG RIVER

5.2 Flood Hazard Factors

The FHF is the FEMA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Borough of Stanhope was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A2: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the Borough of Stanhope.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Borough of Stanhope is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of

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flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FEMA.

6.0 OTHER STUDIES

Contacts with local, regional, state and federal agencies and a thorough literature search were conducted to determine the availability of existing studies and data relating to discharge analyses and flood elevations in Stanhope. Reports containing flood elevation data were compared to results here. Flood Insurance Studies are currently being prepared for the Townships of Byram, Mt. Olive and Roxbury and the Borough of Netcong (References 9, 11, 12 and 13). The results of this study agree exactly with the results of those studies. No other comparative published data pertinent to this study were located.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region II Office, 26 Federal Plaza, Room 19-100, New York, New York 10278.

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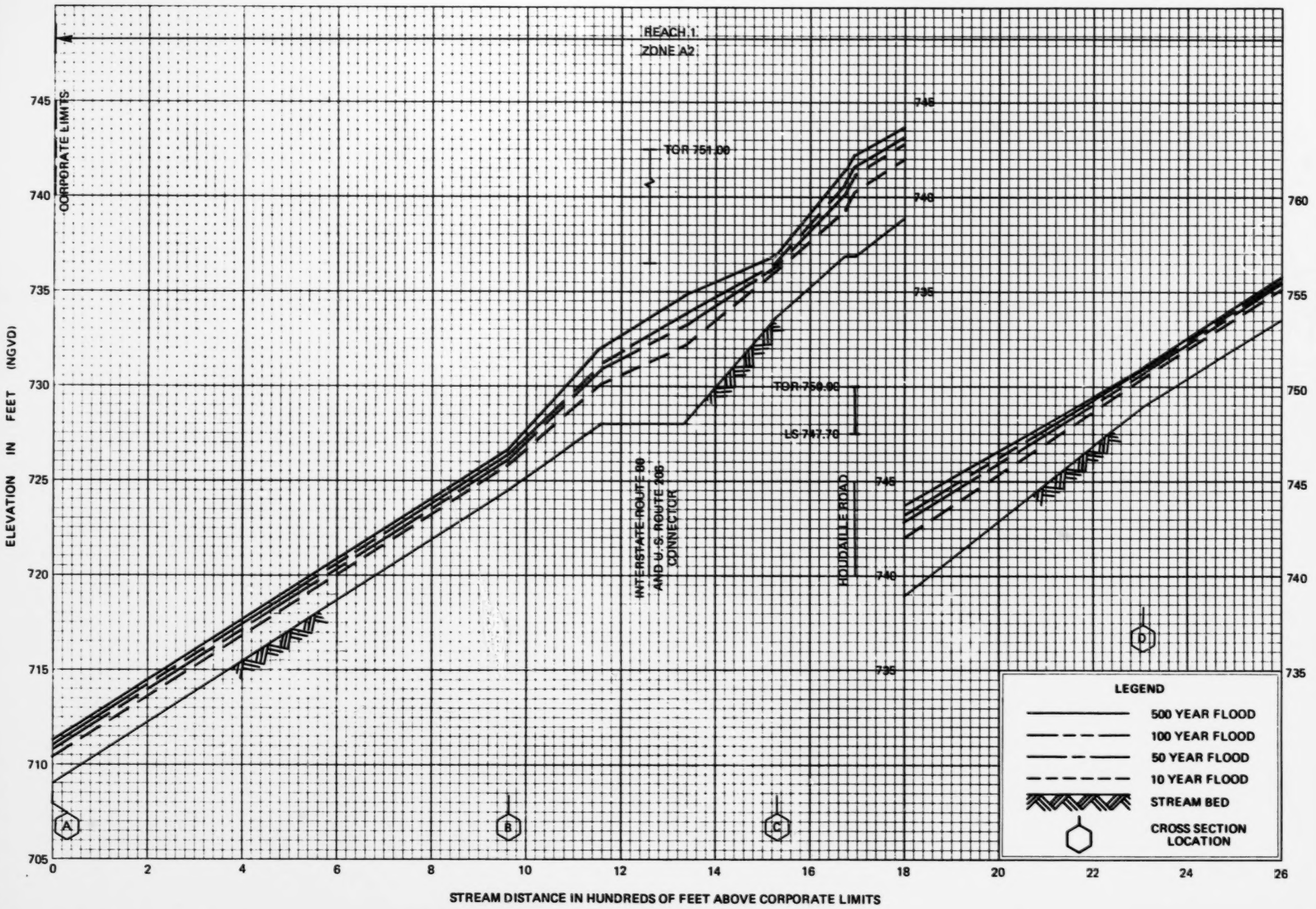

FLOOD PROFILES

MUSCONETCONG RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

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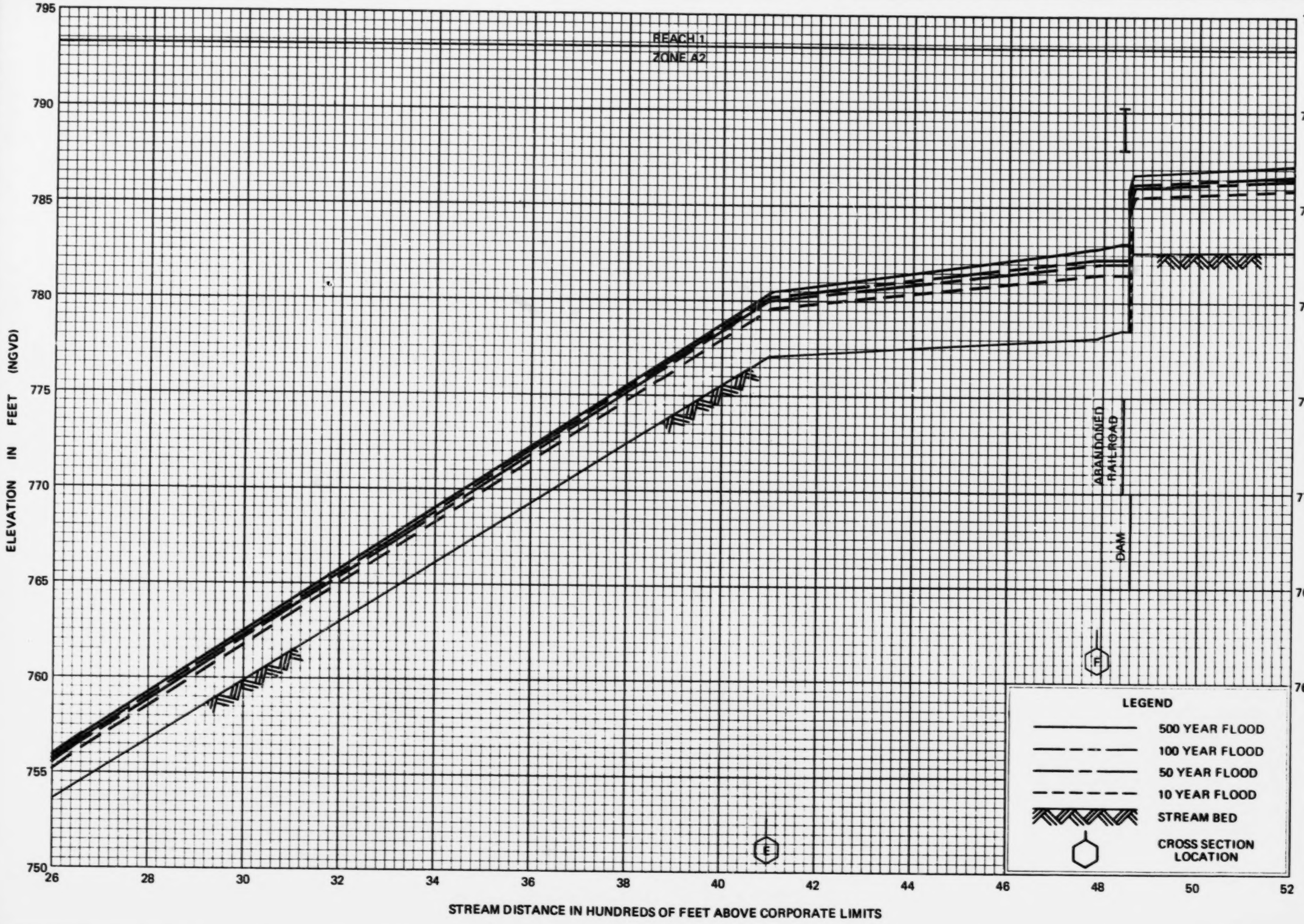

FLOOD PROFILES

MUSCONETCONG RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

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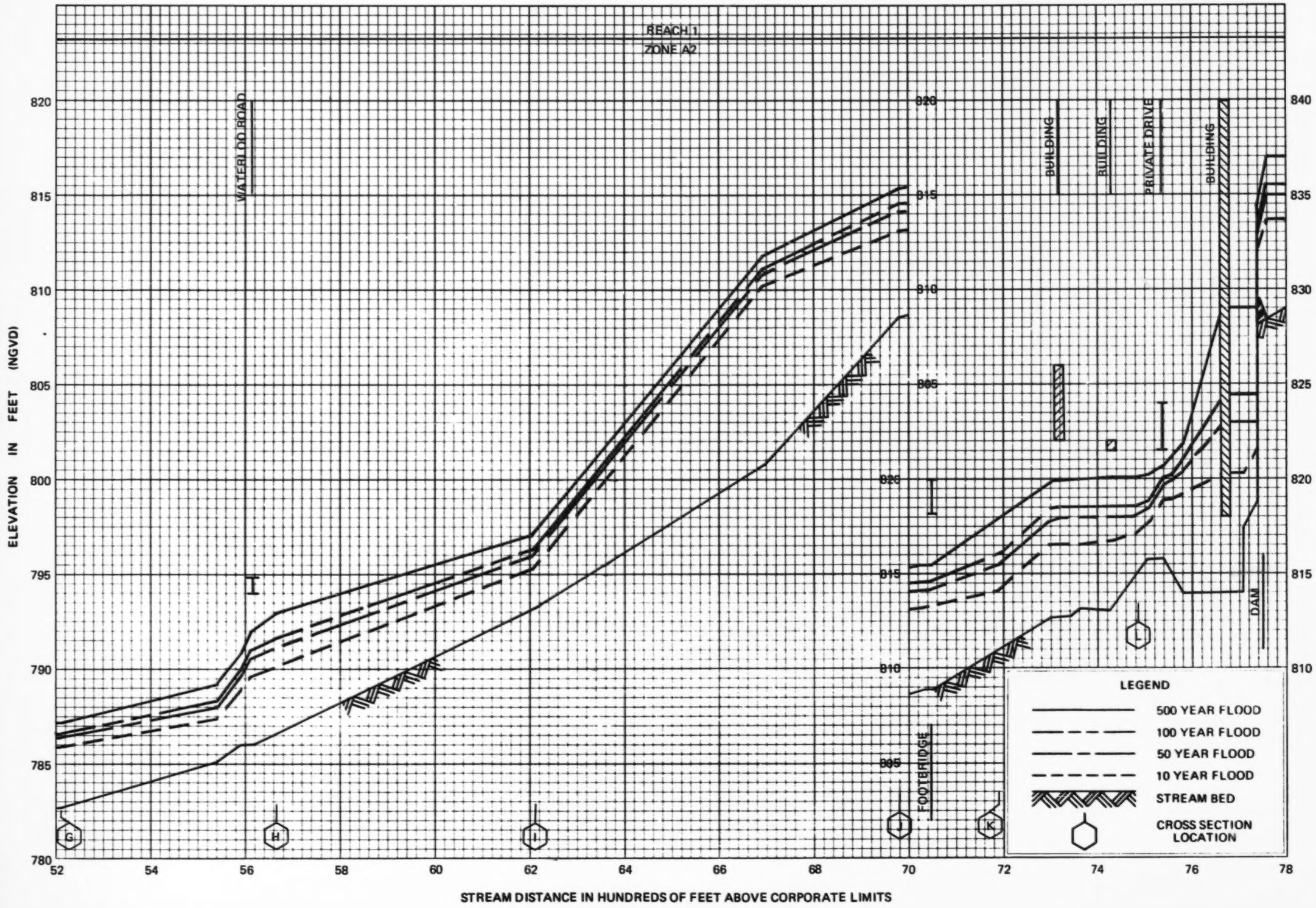

FLOOD PROFILES

MUSCONETCONG RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

03P

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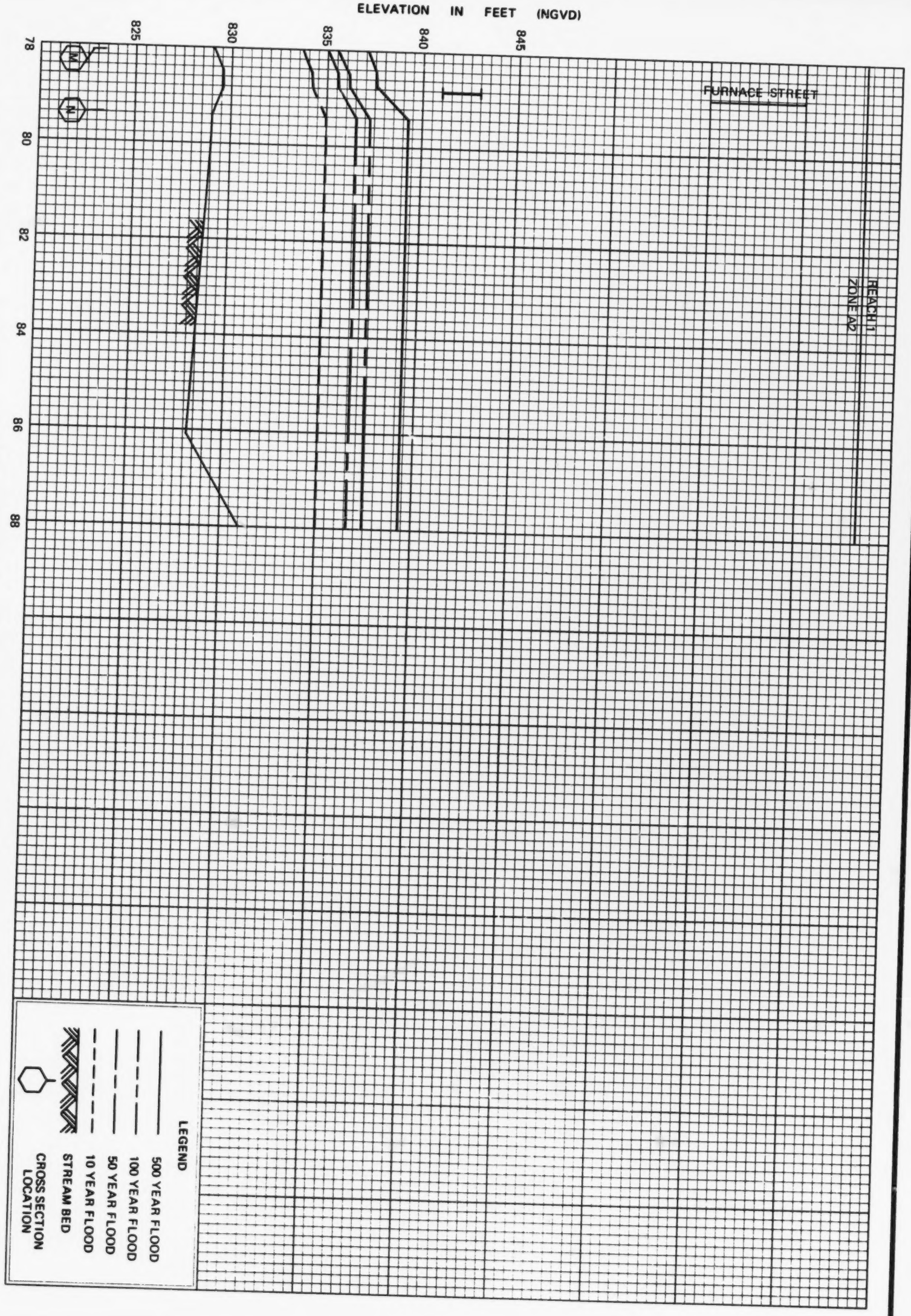

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

FLOOD PROFILES

MUSCONETCONG RIVER

04P

18

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LAKE MUSCONETCONG

REACH 1

ZONE A2

ELEVATION IN FEET (NGVD)

870
865
860
855
850
845
840
835
830

LAKE MUSCONETCONG DAM

US ROUTE 206

O

P

88 92 96 100 104 108 112 116 120 124 128 132 136 140

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CORPORATE LIMITS

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

MUSCONETCONG RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF STANHOPE, NJ
(SUSSEX CO.)

05P

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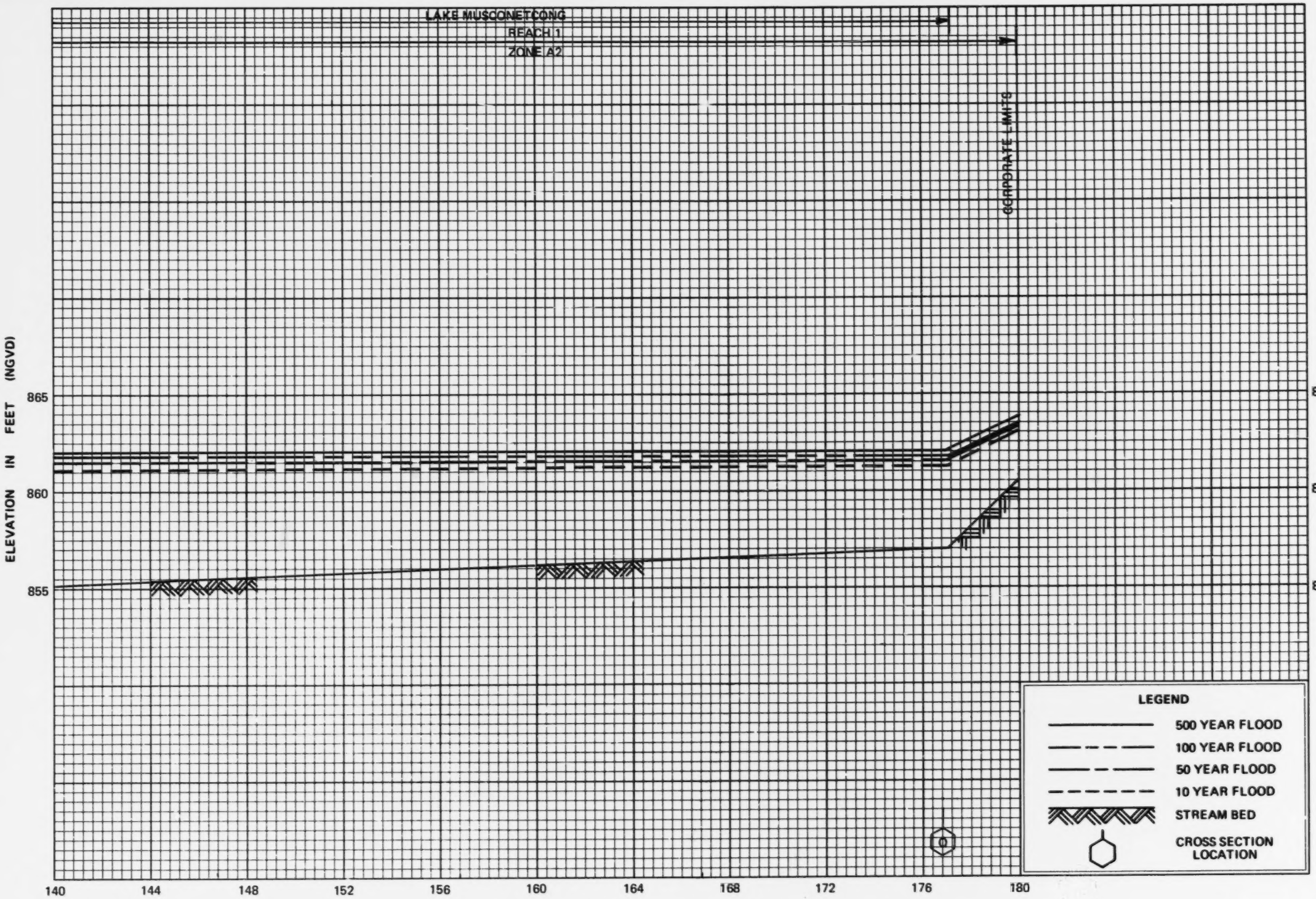

FLOOD PROFILES

MUSCONETCONG RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

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(SUSSEX CO.)

06P

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